Stoller
Hanford Office

DOE-EM/GJ886-2005

299-W15-07 (A5476)
Log Data Report

Borehole Information:

Borehole:	299-W15-07 (A5476)		Site:	216-Z-7 Crib	
Coordinates (WA State Plane)		GWL (ft)[1]:	225.4	GWL Date:	04/19/05
North	East	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
135920.204	566675.883	03/66	670.11	225	Cable

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded steel	2.75	8 5/8	8	5/16	2.75	350

Borehole Notes:

The logging engineer used a caliper to determine the inside and outside casing diameters. All measurements were rounded to the nearest 1/16 in.

Prior to logging on 04/19/05, the borehole was swabbed by a Health Physics Technician (HPT), who found no activity above background. Wipes of the logging cable on 04/20/05 showed activity above background. The cable wipes were re-surveyed the next day and the activity was found to be at background levels, suggesting the elevated activity measured on 04/20/05 was caused by radon.

All logging measurements are referenced to the top of casing.

Logging Equipment Information:

Logging System:	Gamma 1E		Type: SGLS (70%) 34TP40587A
Calibration Date:	04/05	Calibration Reference:	DOE-EM/GJ864-2005
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Logging System:	Gamma 4I		Type: Passive Neutron U1754
Calibration Date:	None	Calibration Reference:	None
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3 - Repeat	4	
Date	04/19/05	04/20/05	04/21/05	04/21/05	
Logging Engineer	Spatz	Spatz	Spatz	Spatz	
Start Depth (ft)	3.0	29.0	170.0	201.0	
Finish Depth (ft)	30.0	200.0	200.0	273.0	

Log Run	1	2	3 - Repeat	4	
Count Time (sec)	100	100	100	100	
Live/Real	R	R	R	R	
Shield (Y/N)	N	N	N	N	
MSA Interval (ft)	1.0	1.0	1.0	1.0	
ft/min	N/A[3]	N/A	N/A	N/A	
Pre-Verification	AE053CAB	AE054CAB	AE055CAB	AE055CAB	
Start File	AE053000	AE054000	AE055000	AE055031	
Finish File	AE053027	AE054171	AE055030	AE055103	
Post-Verification	AE053CAA	AE054CAA	AE055CAA	AE055CAA	
Depth Return Error (in.)	N/A	+ 1	N/A	+ 2	
Comments	No fine gain adjustment.	No fine gain adjustment.	No fine gain adjustment.	No fine gain adjustment.	

Passive Neutron Logging System (PNLS) Log Run Information:

Log Run	5	6 - Repeat			
Date	04/25/05	04/25/05			
Logging Engineer	Pope	Pope			
Start Depth (ft)	3.0	85.0			
Finish Depth (ft)	130.0	98.0			
Count Time (sec)	N/A	N/A			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	0.25	0.25			
ft/min	1	1			
Pre-Verification	DI102CAB	DI102CAB			
Start File	DI102000	DI102508			
Finish File	DI102507	DI102559			
Post-Verification	DI102CAA	DI102CAA			
Depth Return Error (in.)	N/A	N/A			
Comments	None	None			

Logging Operation Notes:

Pre- and post-survey verification measurements for the SGLS were acquired using the Amersham KUT (^{40}K, ^{238}U, and ^{232}Th) verifier with serial number 118. A centralizer was installed on the sonde. Maximum logging depth was chosen to be 273 ft, approximately 48 ft below groundwater level, because of unknown conditions in the borehole. This depth matches the maximum logging depth achieved in 1995 when Westinghouse Hanford Company acquired data in the borehole with the Radionuclide Logging System (RLS).

Passive neutron logging was also performed in the borehole. This logging method has been effective in qualitatively detecting zones of alpha-emitting contaminants from secondary neutron flux generated by the (α,n) reaction and may indicate the presence of transuranic radionuclides.

Analysis Notes:

Analyst:	Henwood	Date:	05/02/05	Reference:	GJO-HGLP 1.6.3, Rev. 0

SGLS pre-run and post-run verification spectra were collected at the beginning and end of each day of logging. All of the SGLS verification spectra were within the acceptance criteria. Examinations of data indicate that the detectors functioned normally during logging, and the data are accepted.

Verification spectra using an AmBe neutron source were acquired for the passive neutron logging system. Currently there are no verification criteria established for this system. The counts obtained from the pre and post verifications were within 1 percent.

Log spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source file: G1EMar05.xls). The casing configuration was assumed as one string of 8 5/8-in. OD casing with a thickness of 5/16 in. to total depth (273 ft). No dead time corrections were applied to the data. A correction for water was required below 225.4 ft.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 1764 keV is used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it exhibited slightly higher net counts per second. PNLS data plotted with total gamma data are also provided.

RLS data acquired in 1995 are plotted with the current SGLS data to determine if changes have occurred since 1995.

Total gamma data acquired in 1976 are plotted with the current SGLS total gamma data to provide a further comparison of activity levels in the borehole.

Results and Interpretations:

^{137}Cs, ^{60}Co, and ^{154}Eu were the man-made radionuclides detected in this borehole. ^{137}Cs was detected near the ground surface between 3 and 18 ft at a maximum concentration of approximately 0.3 pCi/g at 14 ft. It was also detected at a few sporadic depth intervals throughout the borehole near its MDL of approximately 0.2 pCi/g.

^{60}Co was detected almost continuously between 25 and 273 ft. From 25 to approximately 193 ft, the profile is normal (e.g., fluctuating count rates representing deposition in heterogeneous sediment layers). Below 193 ft, the profile indicates almost constant concentrations from 193 to 218 ft and from 223 to 273 ft with decreases centered at 220 ft. It is postulated that the interval from 193 to approximately 220 ft is the result of residual contamination remaining on the casing as historically contaminated groundwater has receded from its highest elevation. It is reported in *Hanford Wells* (Chamness and Merz 1993), for example, that the groundwater level was approximately 197 ft (depth reference unknown) in 1966. At approximately 223 ft, the apparent ^{60}Co concentrations increase slightly and remain at nearly constant levels to the total depth of the logged interval. Here, it is postulated the casing and the groundwater may be contaminated

with ^{60}Co. The fact that ^{60}Co and ^{154}Eu appear to be relatively constant between 193-218 ft and 223-TD suggests the contaminants may be on the casing. However, if all the observed contamination were on the casing or within the formation, one would expect levels to be more or less the same below groundwater level, after the water correction is applied. The fact that the levels increase (as does total gamma) strongly suggests that the water is also contaminated. It is possible the sediments behind the casing are also contaminated to some degree. Thus, the reported concentrations may be in error because the calibration assumes formation activity, only, and does not address possible casing or groundwater contamination. The maximum ^{60}Co concentration above 193 ft measured approximately 5 pCi/g at 86 ft.

^{154}Eu was detected in approximately the same depth intervals and with similar profiles as the ^{60}Co. An exception is between approximately 135 and 180 ft, where little or no ^{154}Eu was detected above its MDL of approximately 0.2 pCi/g. The same scenario as described above for ^{60}Co is hypothesized to apply to the ^{154}Eu. The maximum ^{154}Eu concentration above 193 ft measured approximately 5 pCi/g at 86 ft.

The passive neutron detector indicated no significant neutron flux between the measured interval of 3 to 130 ft. Slight elevation in count rate (0.7 cps) is observed between 3 and 5 ft but is not believed to be related to alpha-emitting contaminants.

The ^{40}K and ^{232}Th logs showed a general increase in concentrations at approximately 45 ft, suggesting a lithology change. Apparent ^{232}Th concentrations are elevated by approximately 0.6 pCi/g in the interval between 105 and 113 ft, and this increase corresponds with fine-grained sediment of the Cold Creek Interval formerly known as the Early Palouse Soil. The relatively low ^{40}K and ^{232}Th values in the interval between 113 and 120 ft, as well as the relatively high ^{238}U values, are characteristic of the carbonate palesols of the Cold Creek Interval. Enhanced radon was observed in this borehole during all log runs except for the first day on April 19.

The comparison of the RLS (1995) and SGLS (2005) data above 193 ft indicates no significant differences or changes in profile. At approximately 201 ft, the RLS data indicated ^{60}Co and ^{154}Eu at their highest concentrations (37 and 22 pCi/g, respectively). It was reported this interval was below the groundwater level at the time of logging in 1995. At 220 ft, the SGLS shows decreases in concentration while the RLS shows no significant change. The cause of these discrepancies is not known but is likely the result of the different groundwater levels at the time of logging. Below 193 ft, log data acquired by the respective logging systems resulted in differing concentrations calculated for ^{60}Co and ^{154}Eu, even though the profiles are generally the same. These discrepancies are likely the result of differing input of groundwater level and corrections for water in the borehole. It is likely the contamination is in a non-standard configuration (i.e., contamination has adhered to the inside of the casing and/or is in the water).

The historical total count log data acquired in 1976 are consistent with the current SGLS total count data, suggesting no significant changes have occurred.

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the natural and man-made radionuclides and the passive neutron.

References:

Chamness, M.A., and J.K. Merz, 1993. *Hanford Wells*, PNL-8800, Pacific Northwest Laboratory, Richland, Washington.

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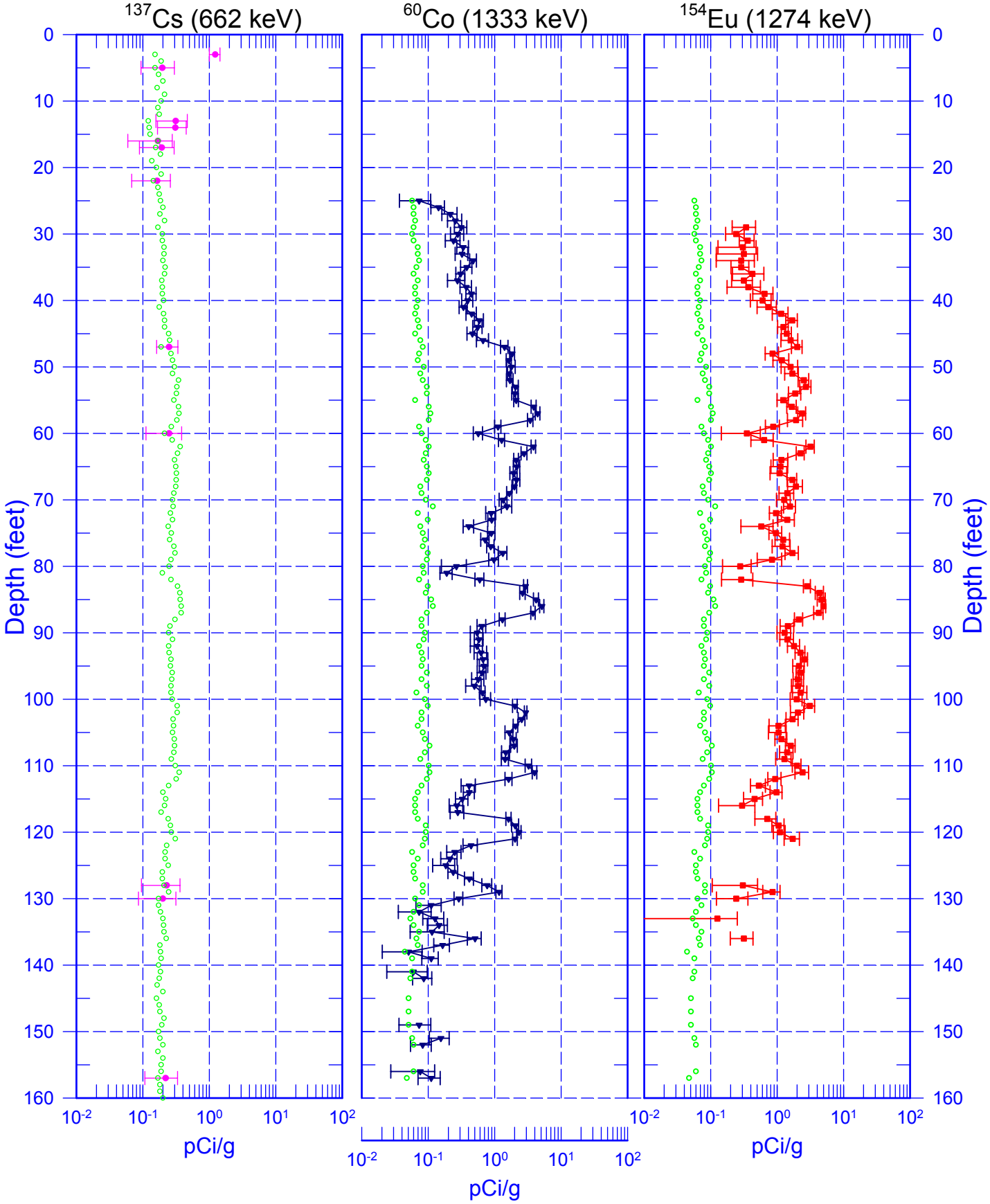
[1] GWL – groundwater level
[2] TOC – top of casing
[3] N/A – not applicable

299-W15-07 (A5476)

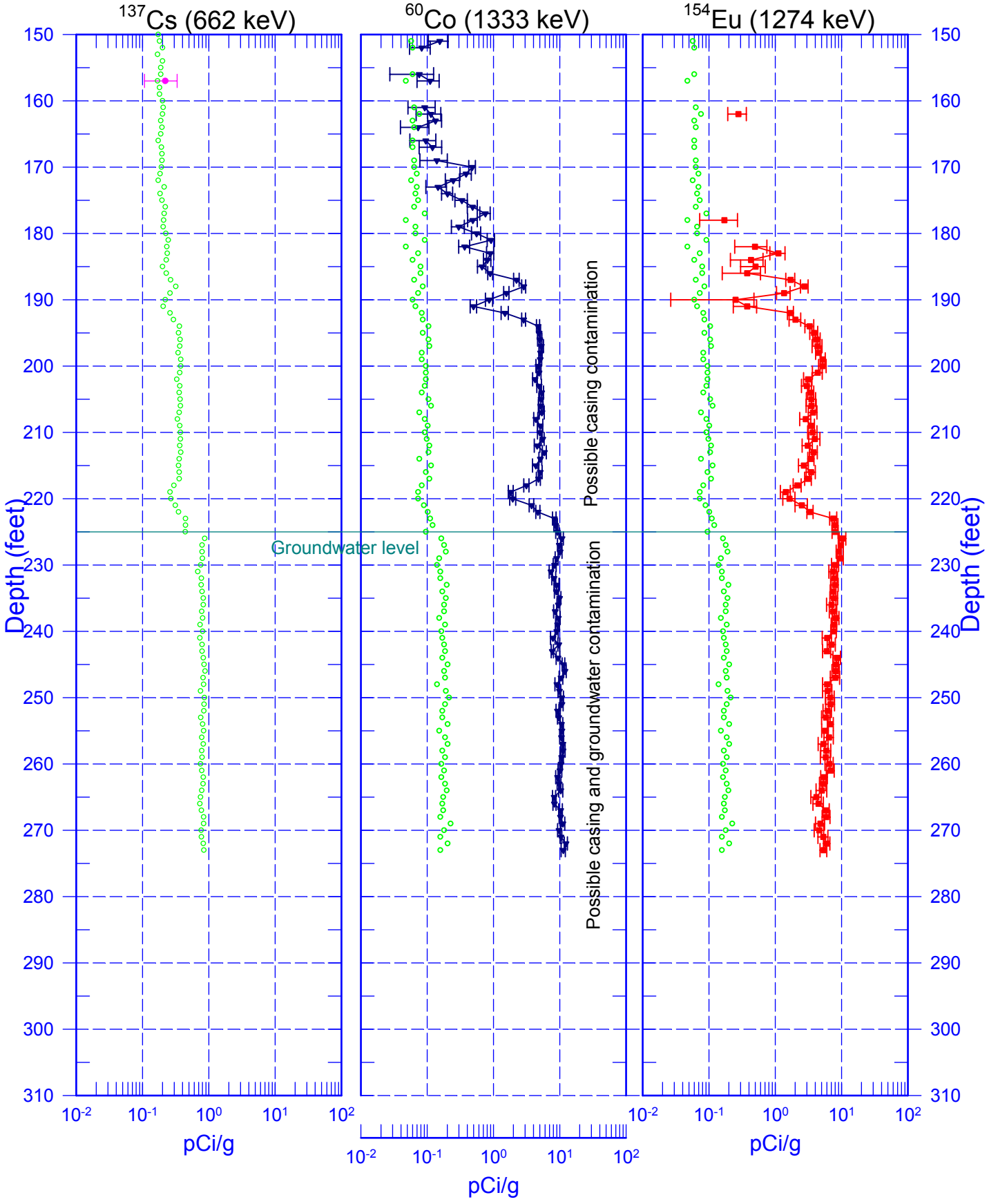
Man-Made Radionuclides



Zero Reference - Top of Casing

Last Log Date - 04/25/05

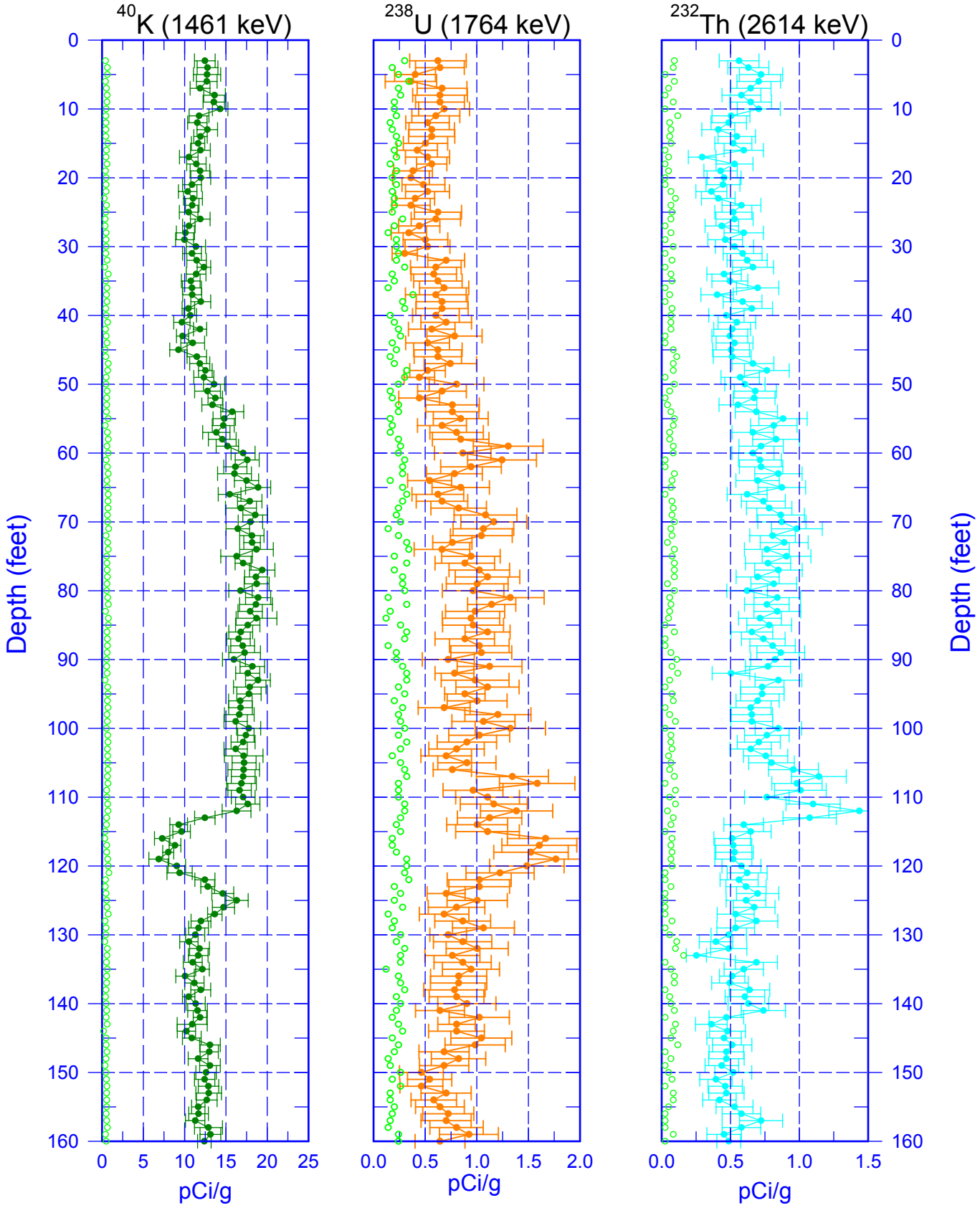
299-W15-07 (A5476)
Man-Made Radionuclides



Zero Reference - Top of Casing

Last Log Date - 04/25/05

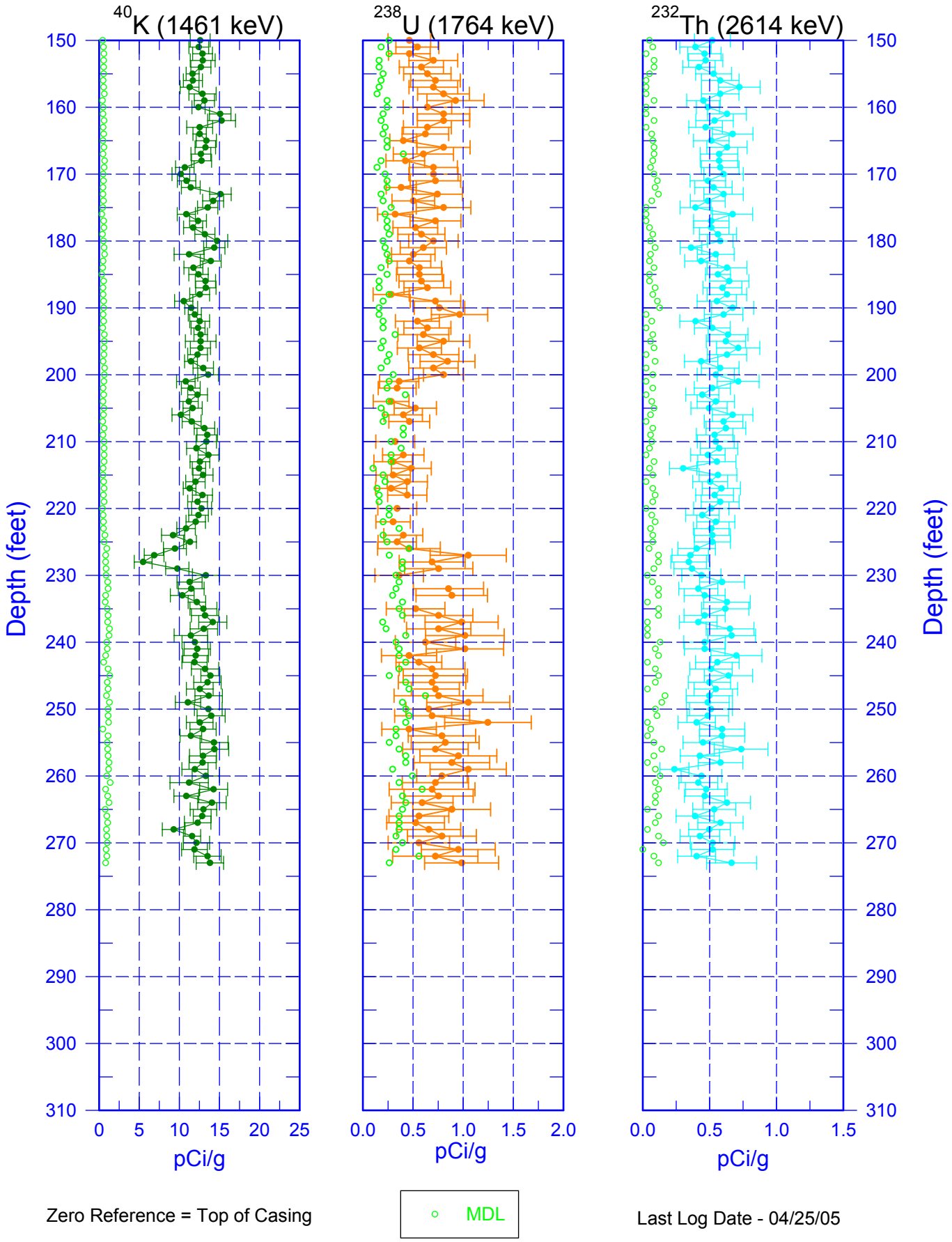
299-W15-07 (A5476)
Natural Gamma Logs



Zero Reference = Top of Casing

Last Log Date - 04/25/05

299-W15-07 (A5476)
Natural Gamma Logs

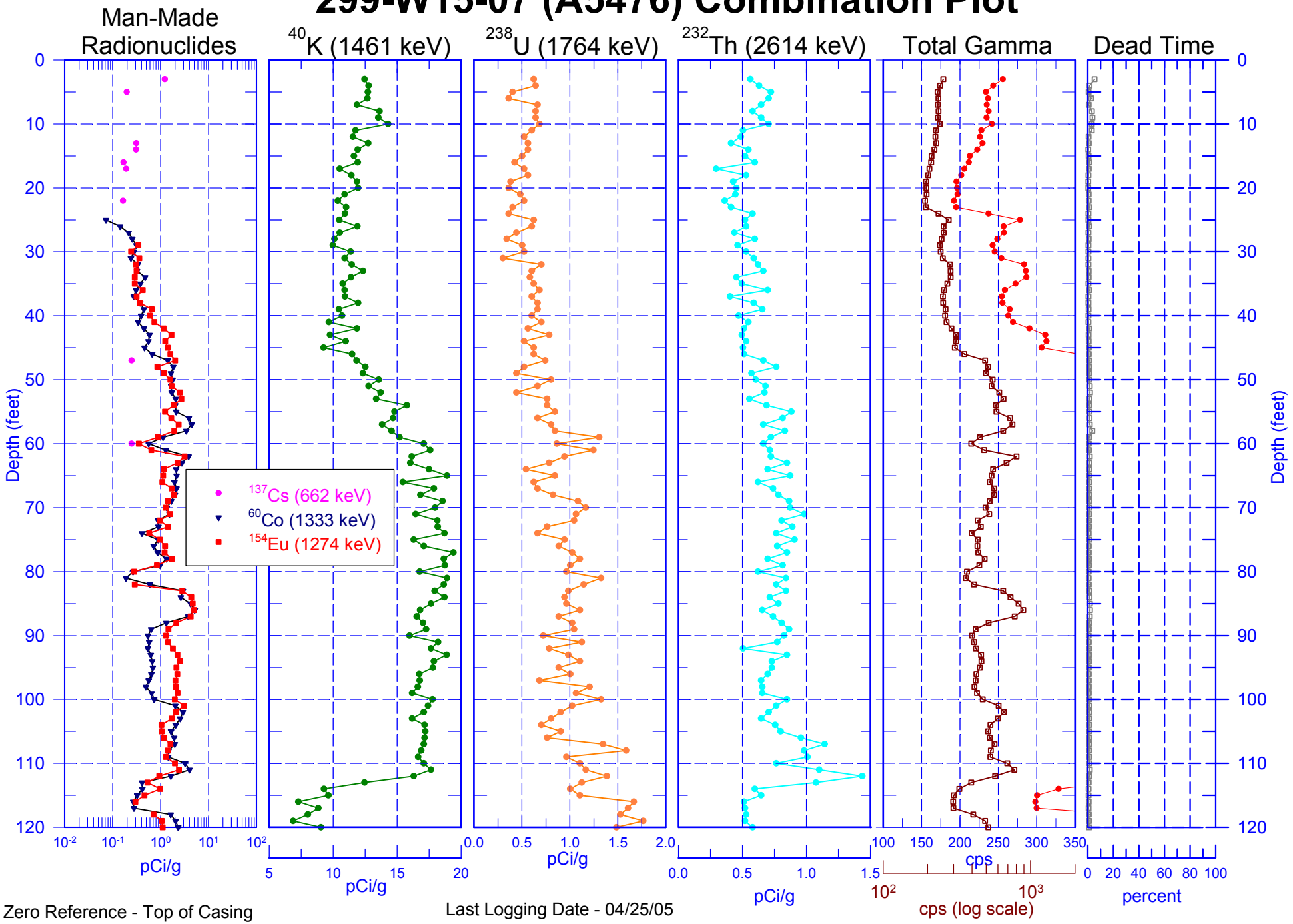


Zero Reference = Top of Casing

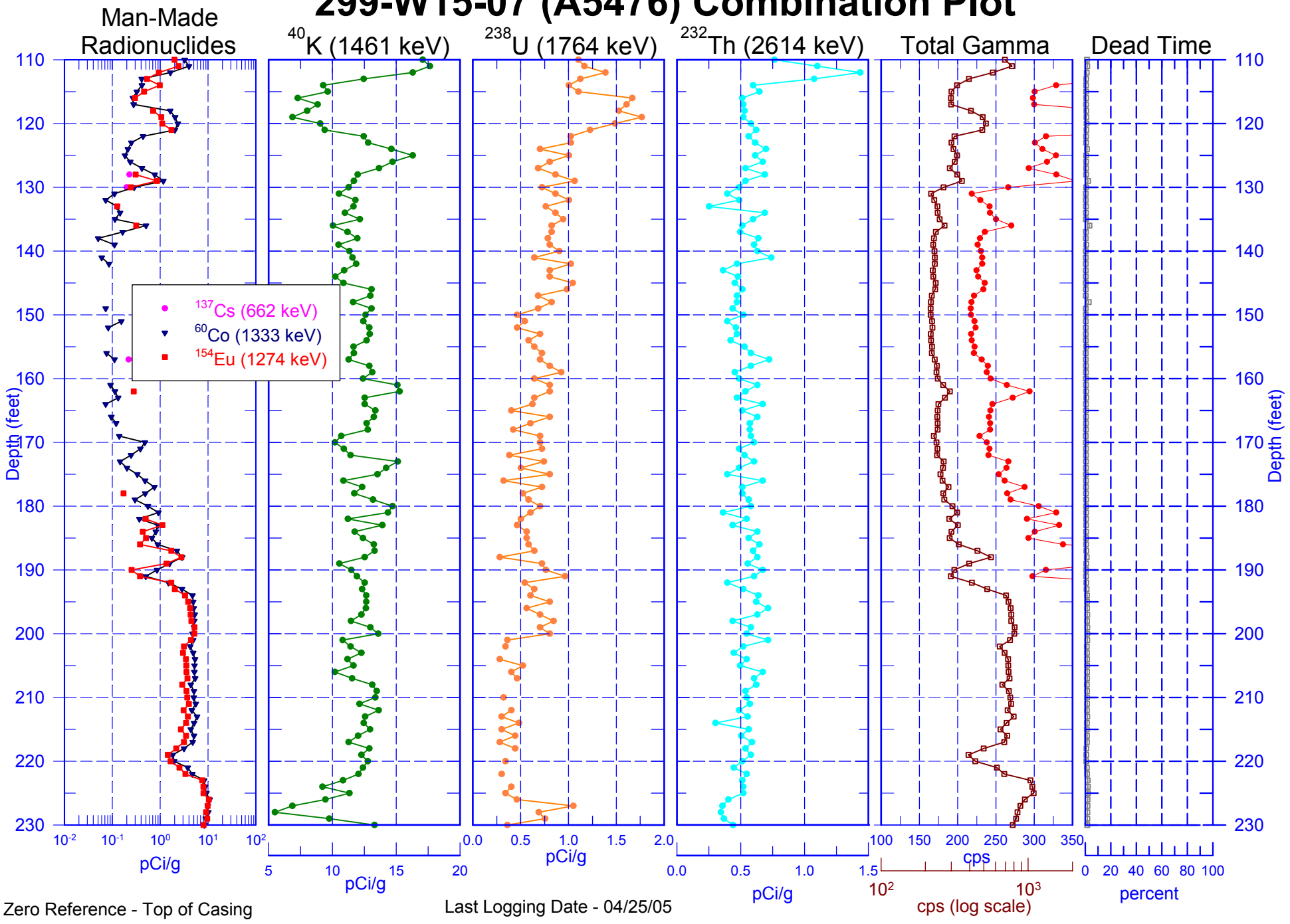
MDL

Last Log Date - 04/25/05

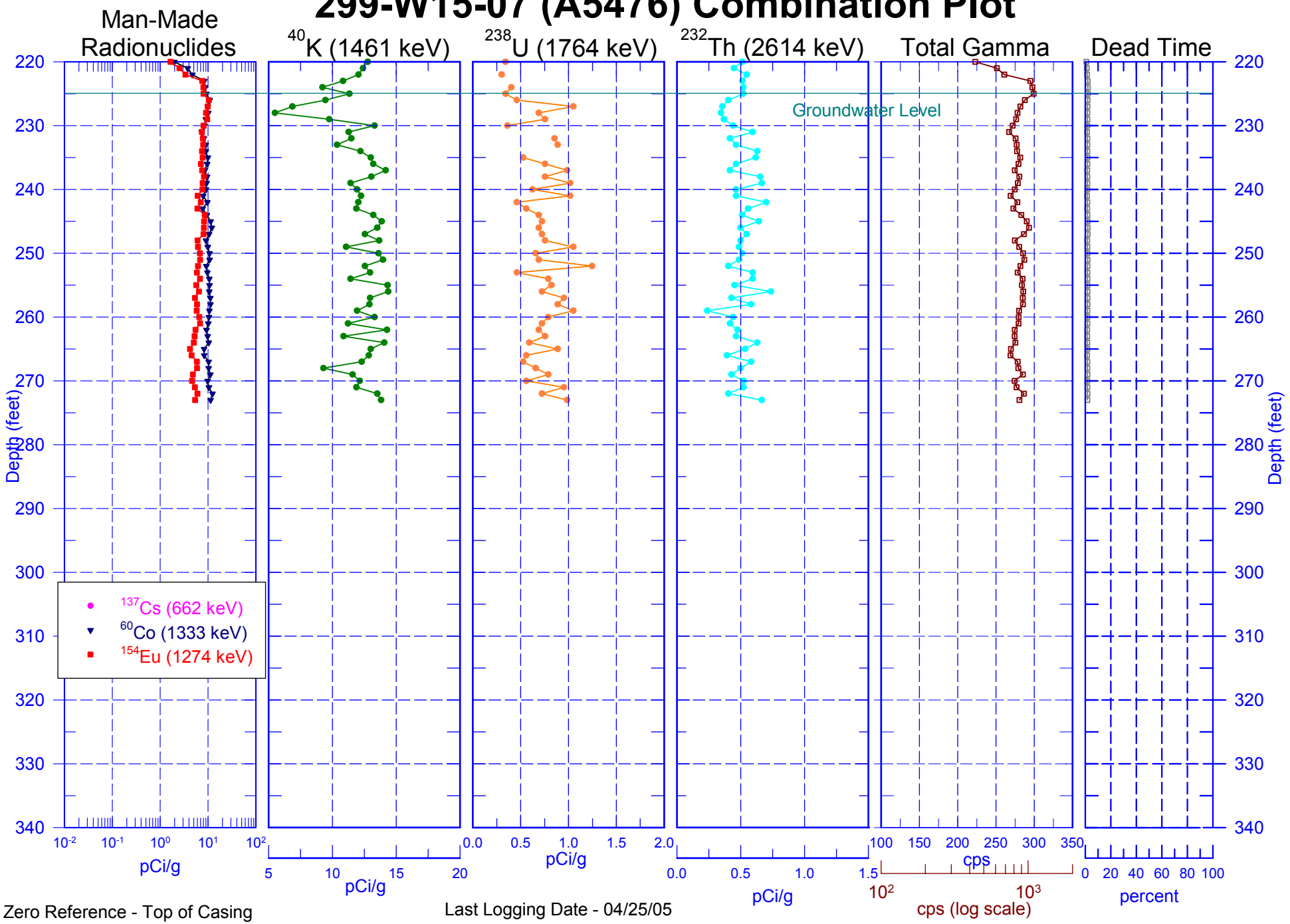
299-W15-07 (A5476) Combination Plot



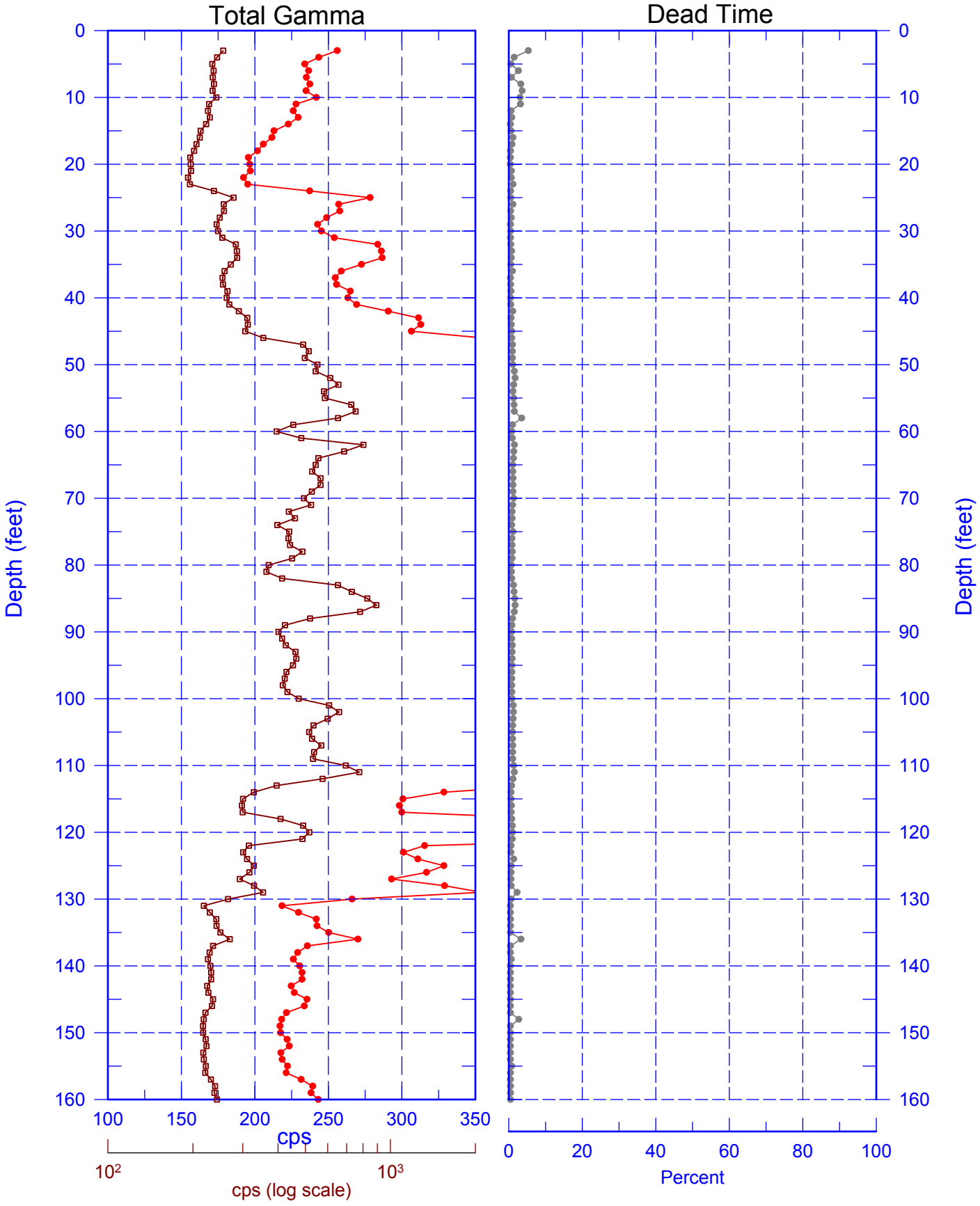
299-W15-07 (A5476) Combination Plot



299-W15-07 (A5476) Combination Plot



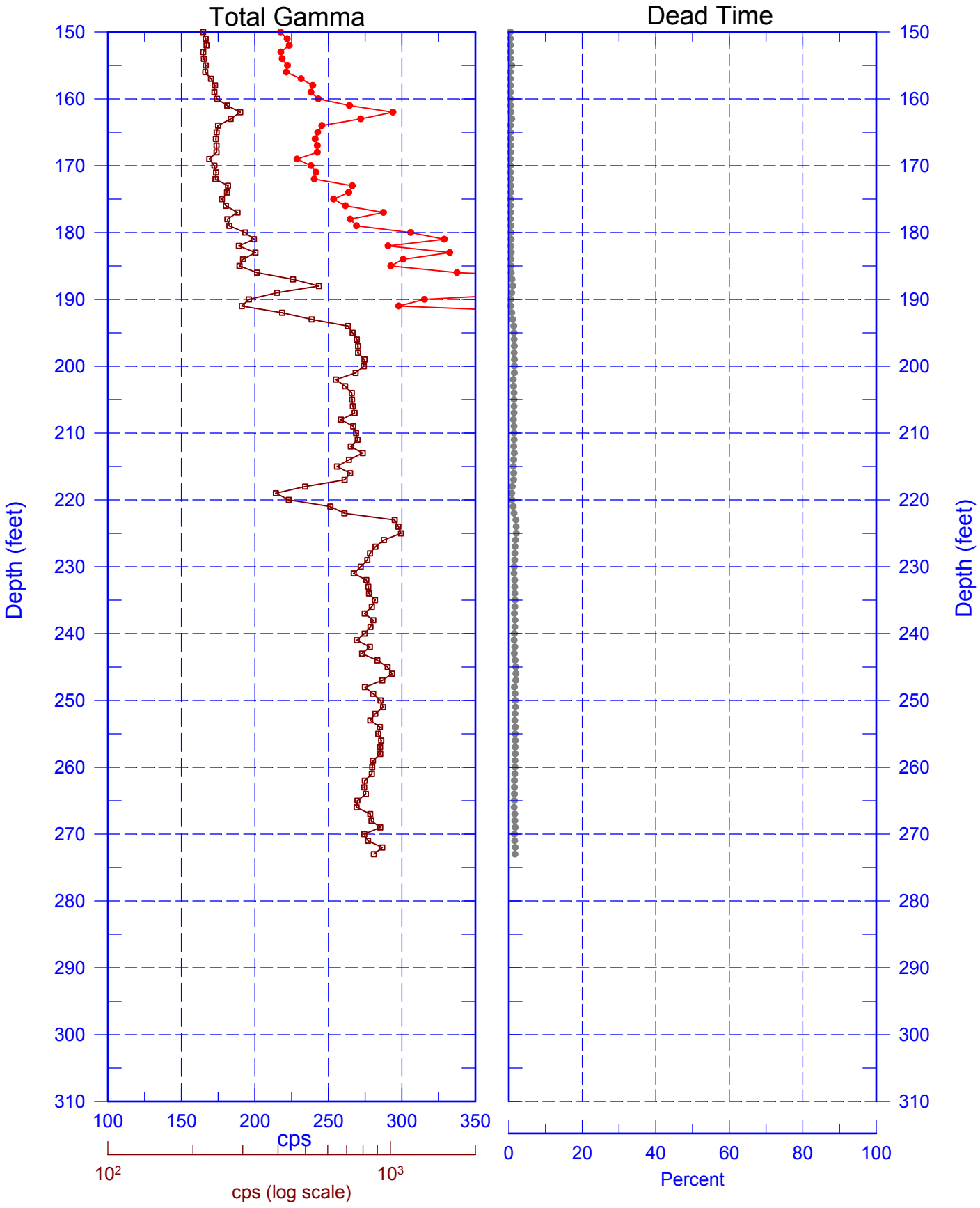
299-W15-07 (A5476)
Total Gamma & Dead Time



Reference - Top of Casing

Last Log Date - 04/25/05

299-W15-07 (A5476)
Total Gamma & Dead Time

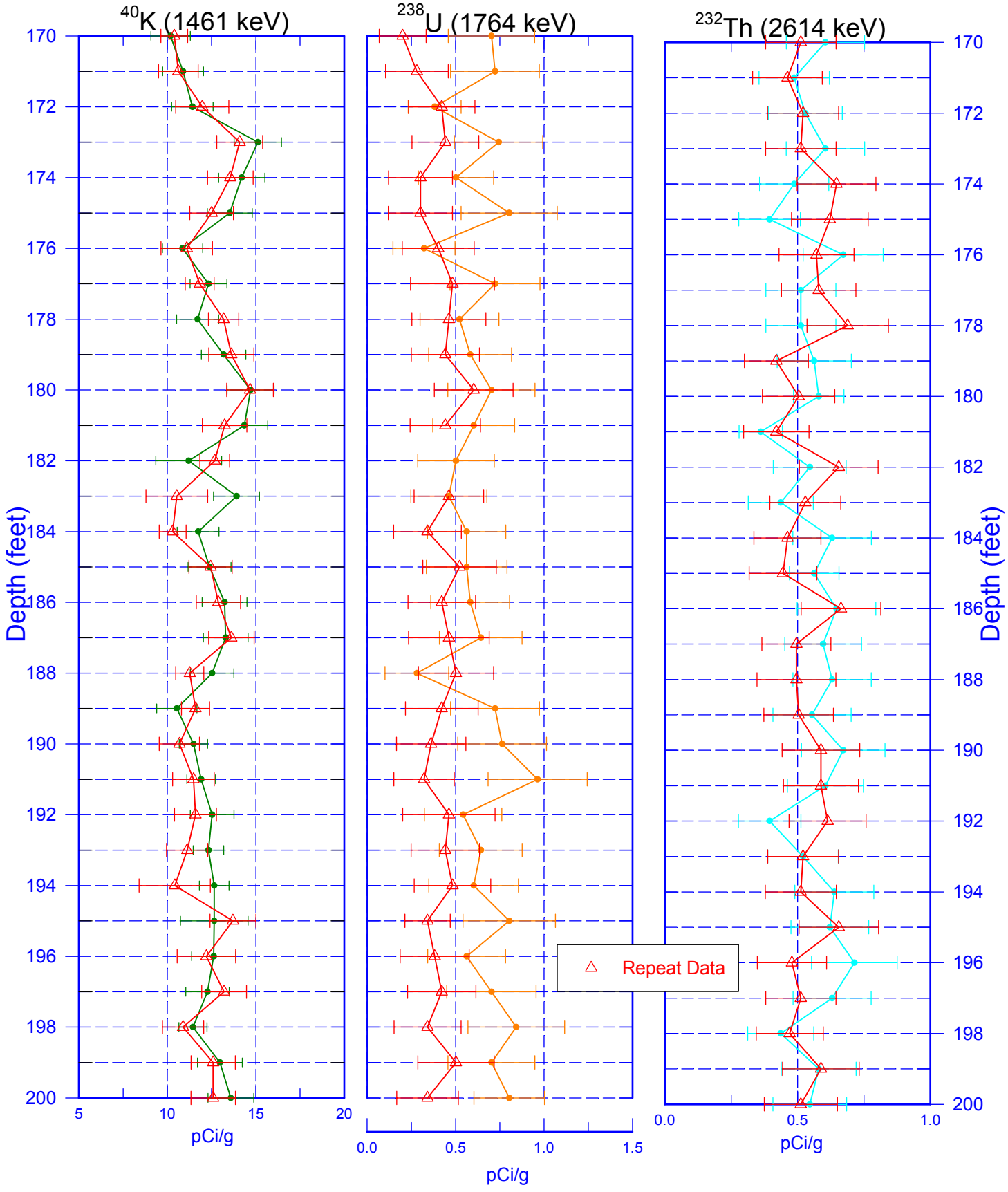


Reference - Top of Casing

Last Log Date - 04/25/05

299-W15-07 (A5476)

Repeat Section of Natural Gamma Logs

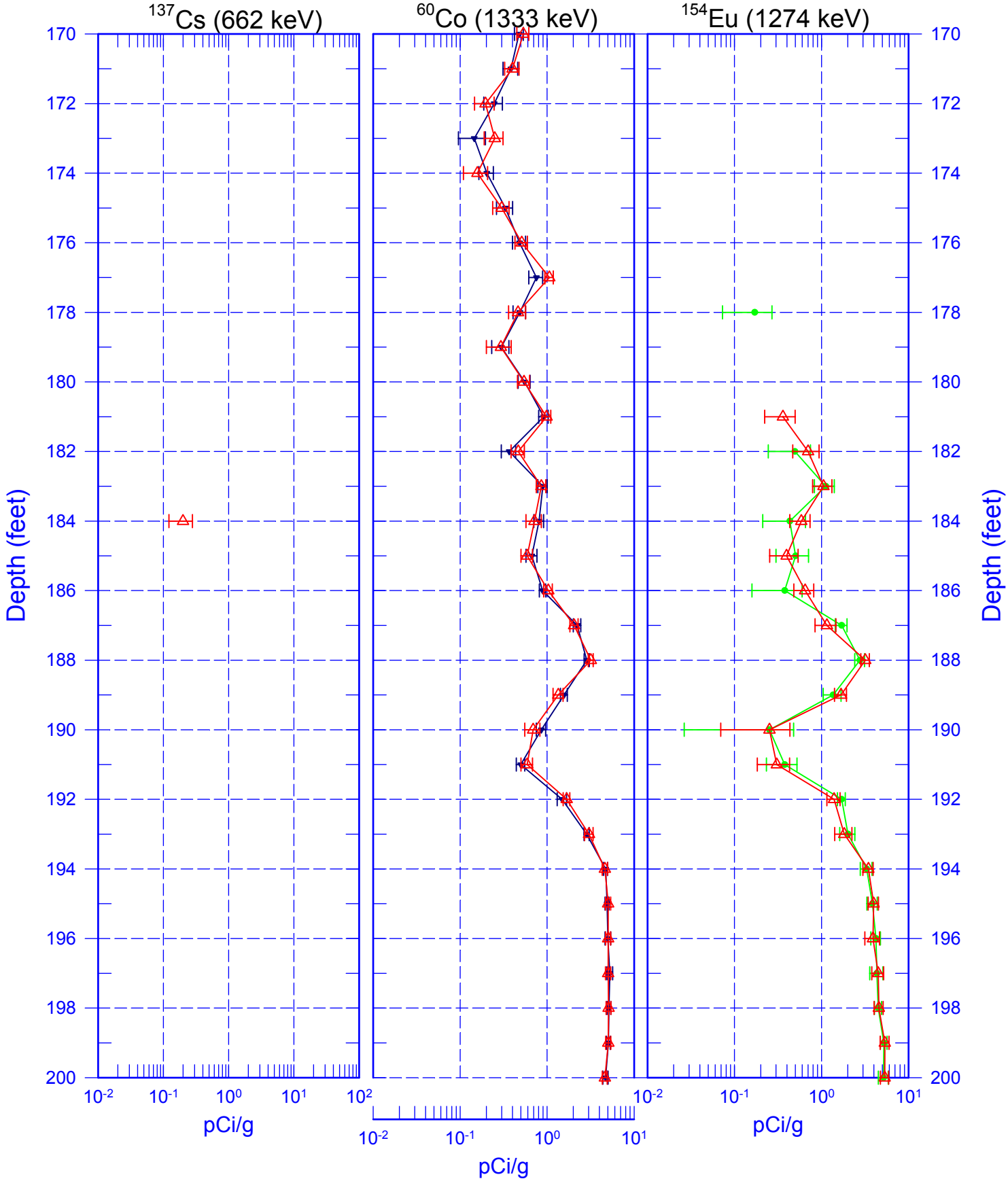


Zero Reference - Top of Casing

Last Log Date - 04/25/05

299-W15-07 (A5476)

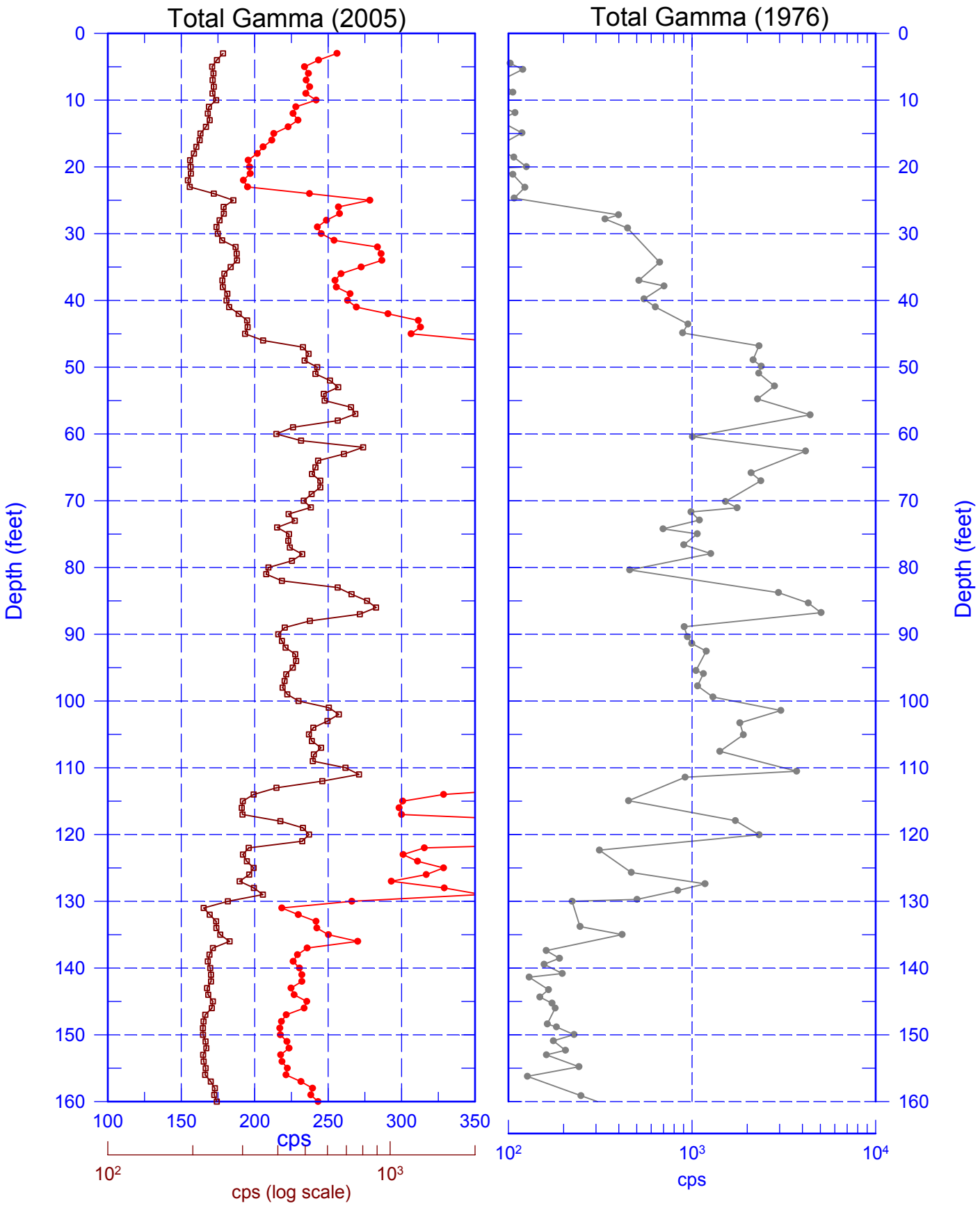
Man-Made Radionuclide Repeat Section



Zero Reference - Top of Casing

Last Log Date - 04/25/05

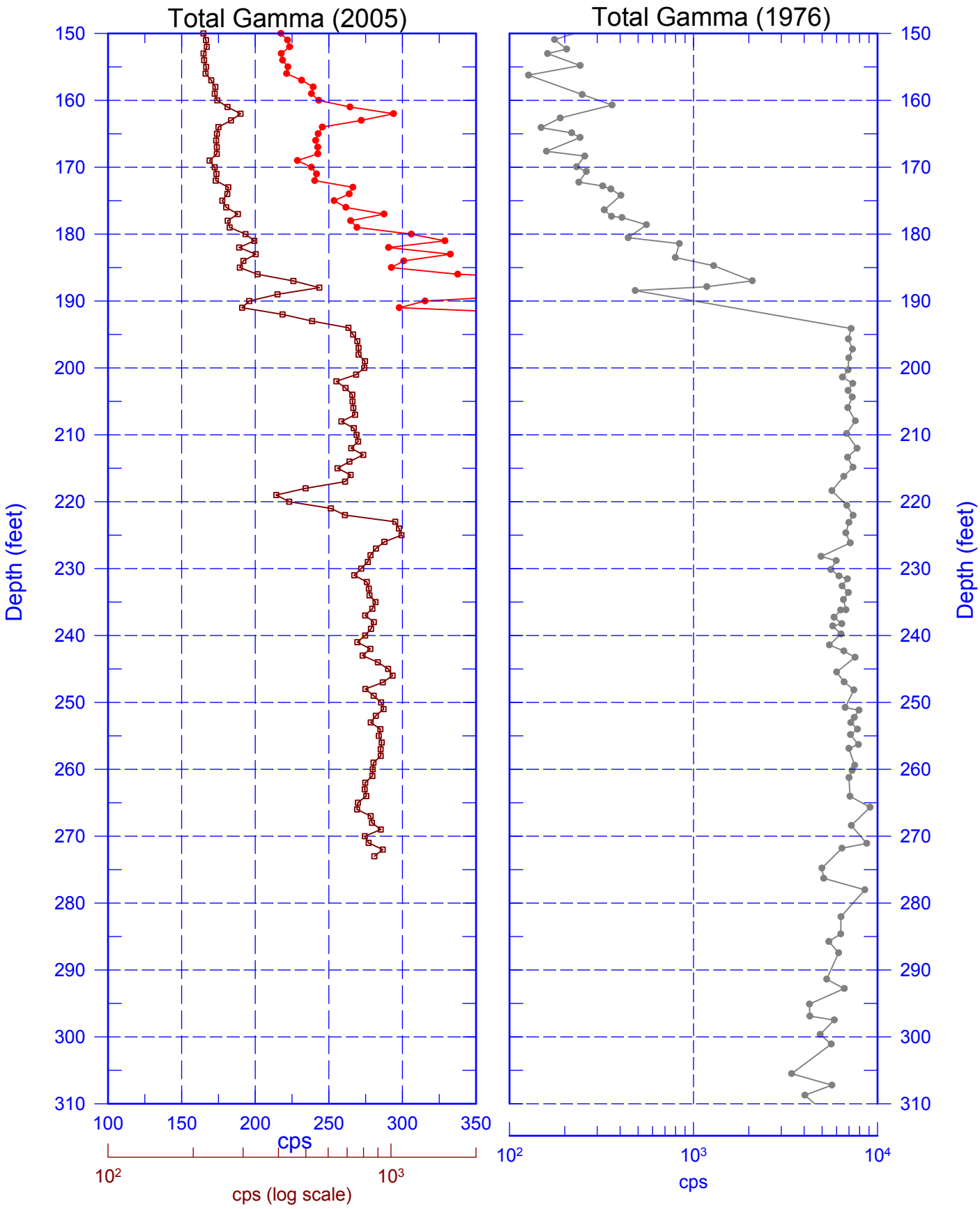
299-W15-07 (A5476)
Historical Total Gamma Comparison



Reference - Top of Casing

Last Log Date - 04/25/05

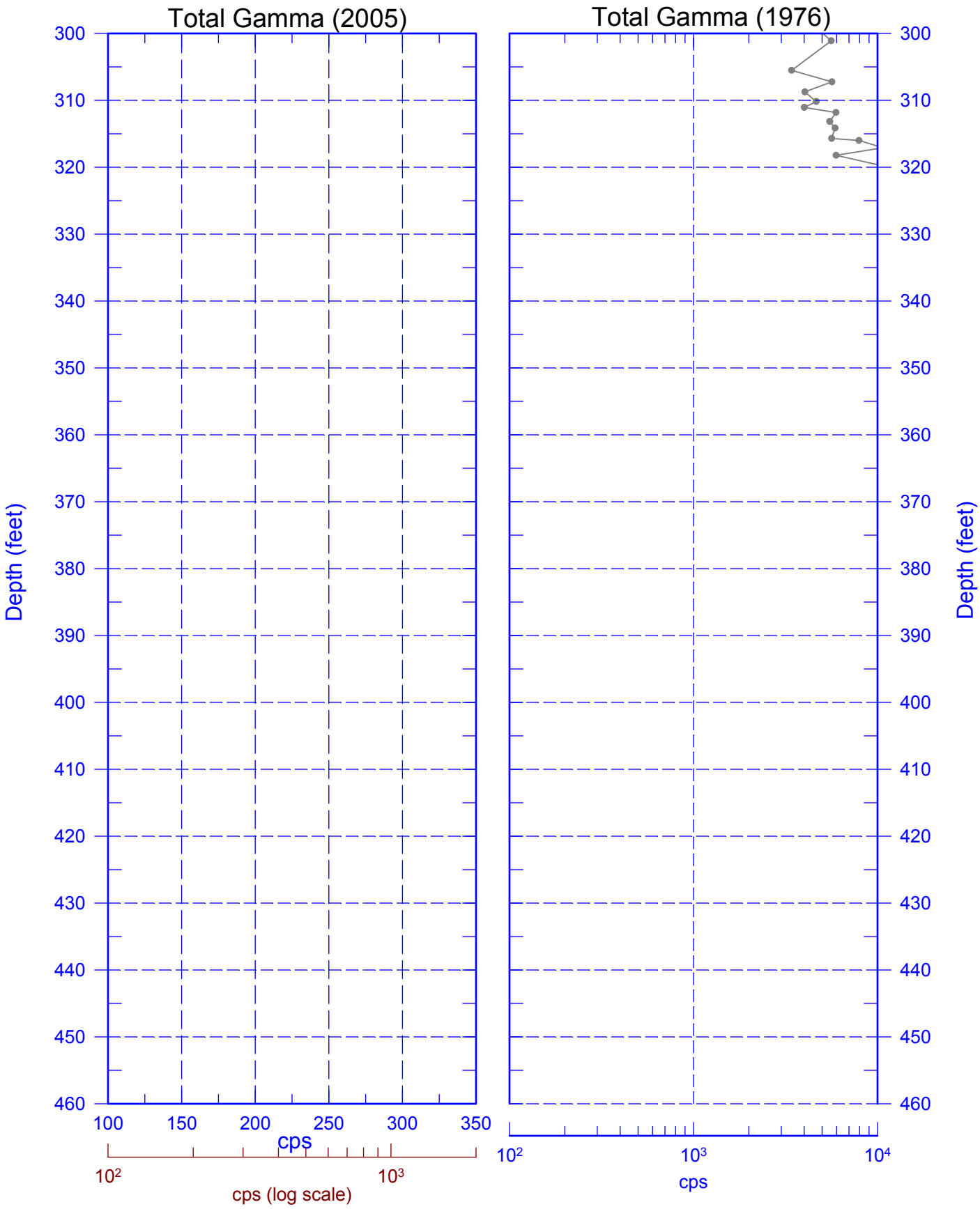
299-W15-07 (A5476)
Historical Total Gamma Comparison



Reference - Top of Casing

Last Log Date - 04/25/05

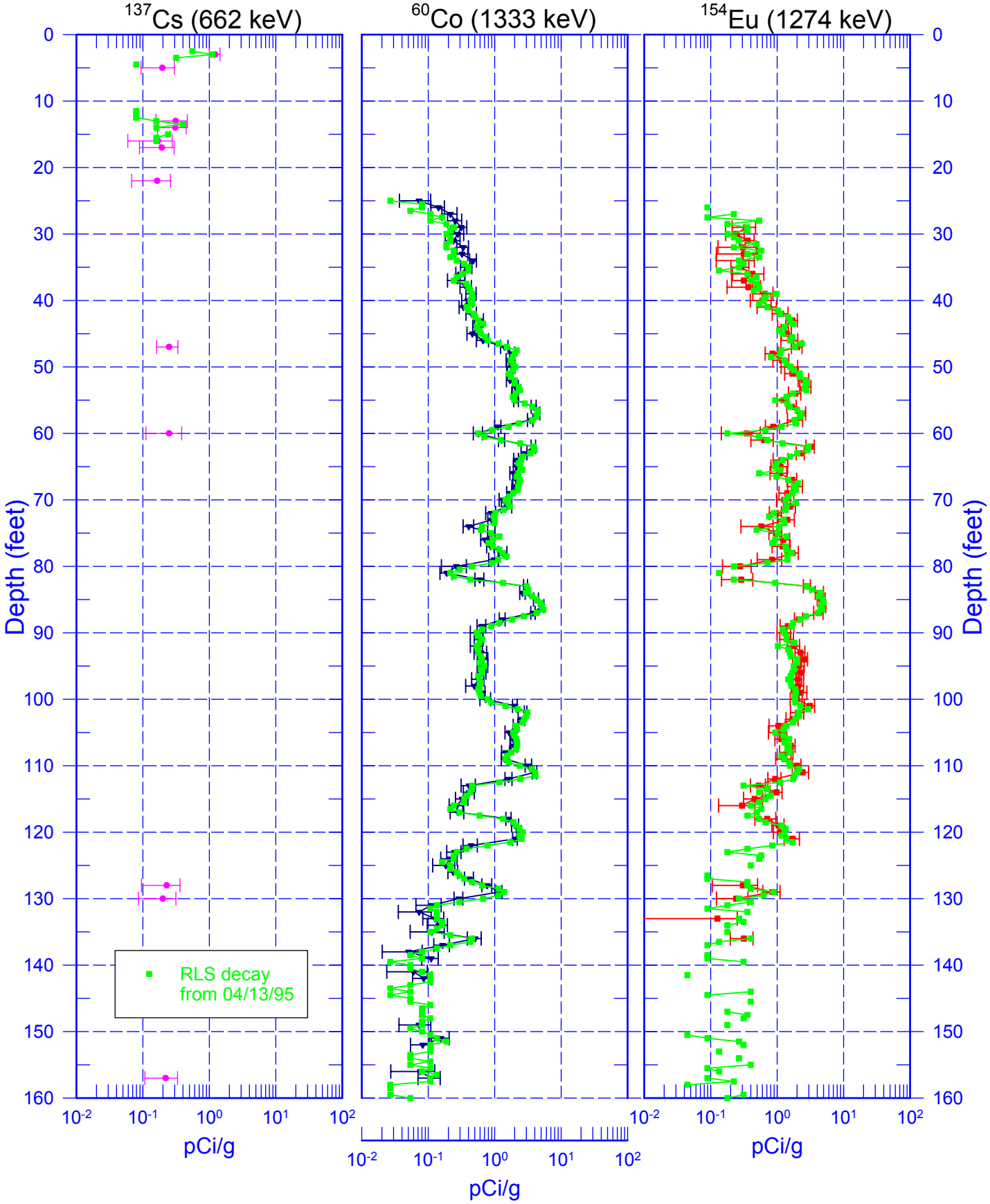
299-W15-07 (A5476)
Historical Total Gamma Comparison



Reference - Top of Casing

Last Log Date - 04/25/05

299-W15-07 (A5476)
Man-Made Radionuclides

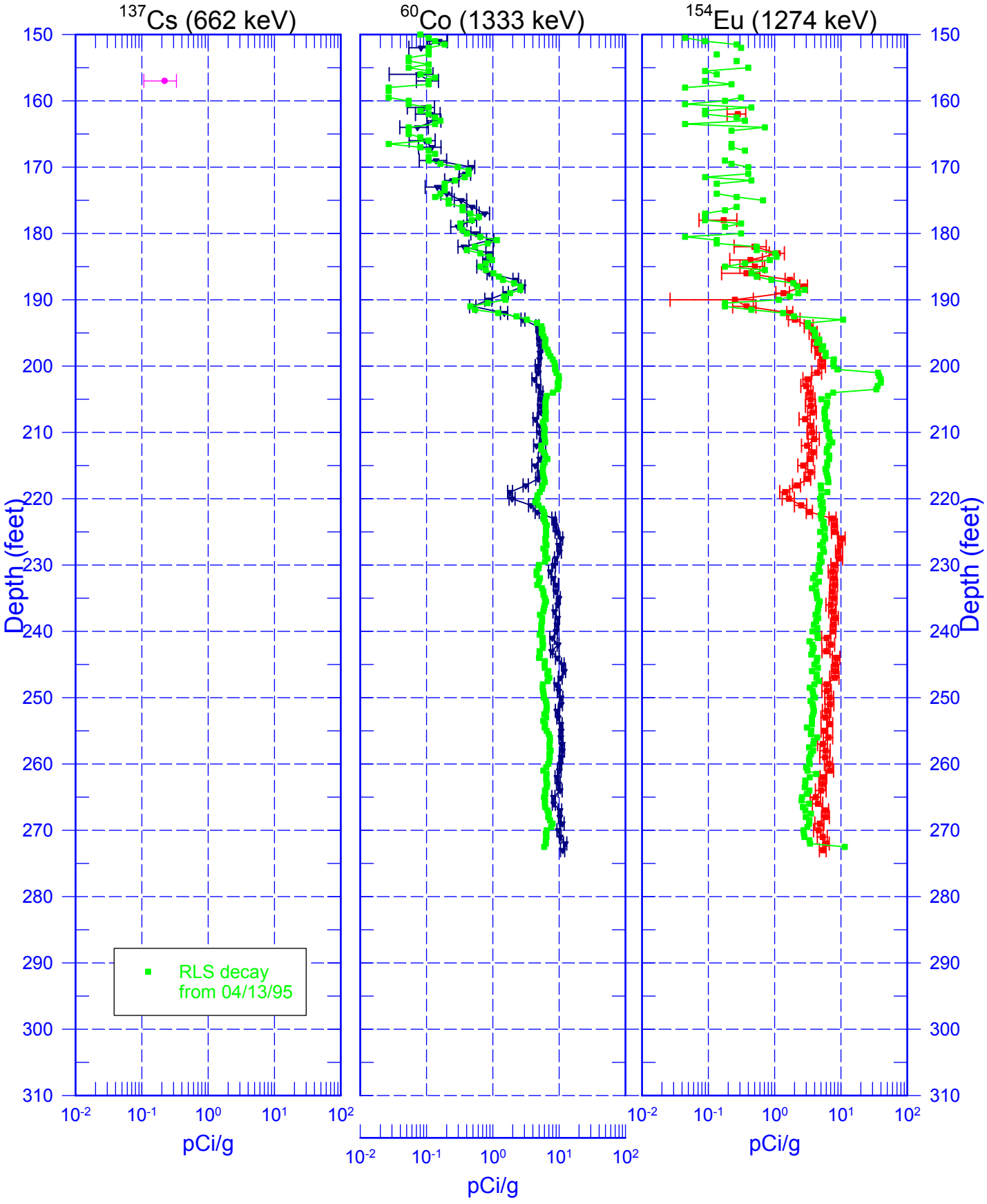


Zero Reference - Top of Casing

Last Log Date - 04/25/05

299-W15-07 (A5476)

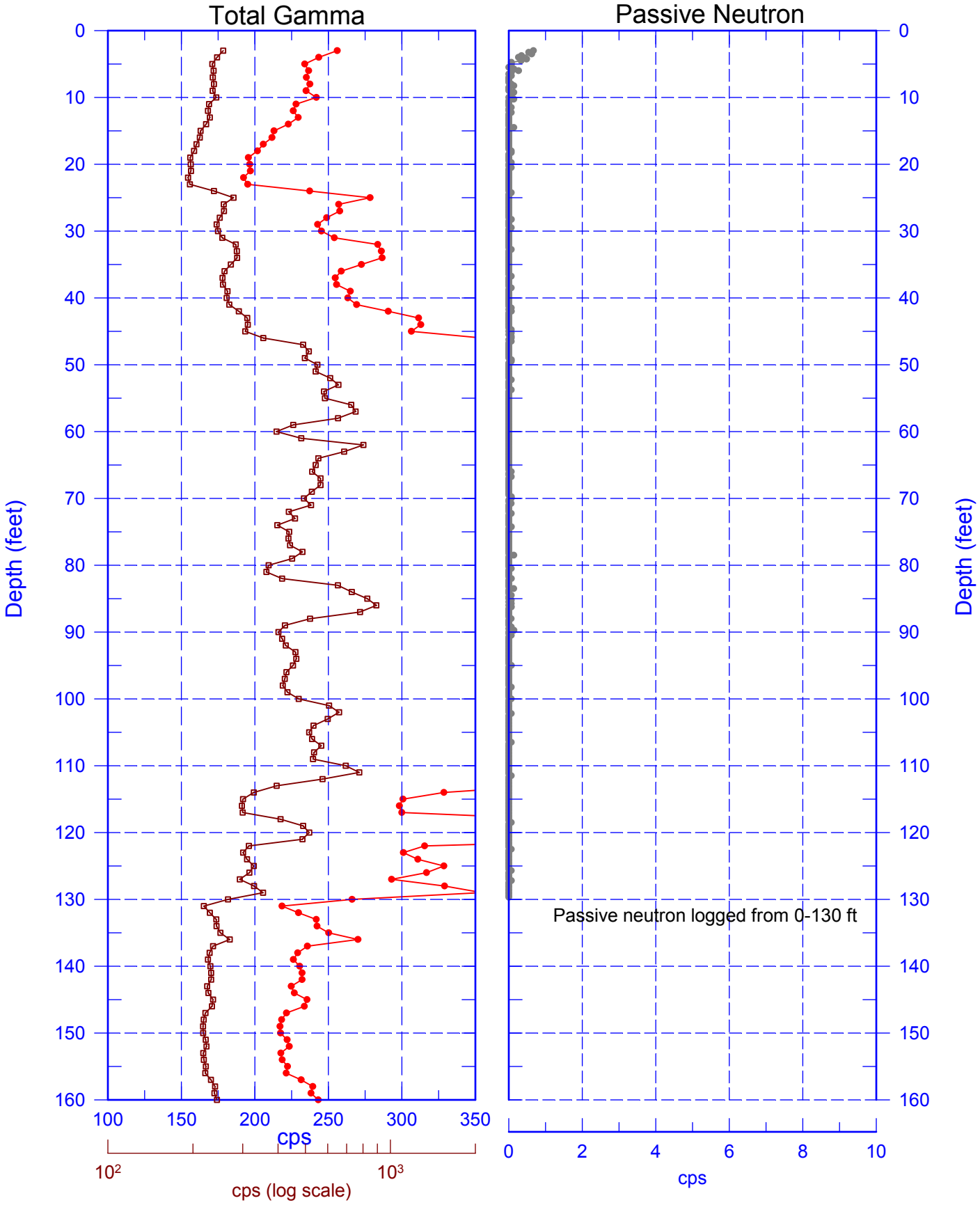
Man-Made Radionuclides



Zero Reference - Top of Casing

Last Log Date - 04/25/05

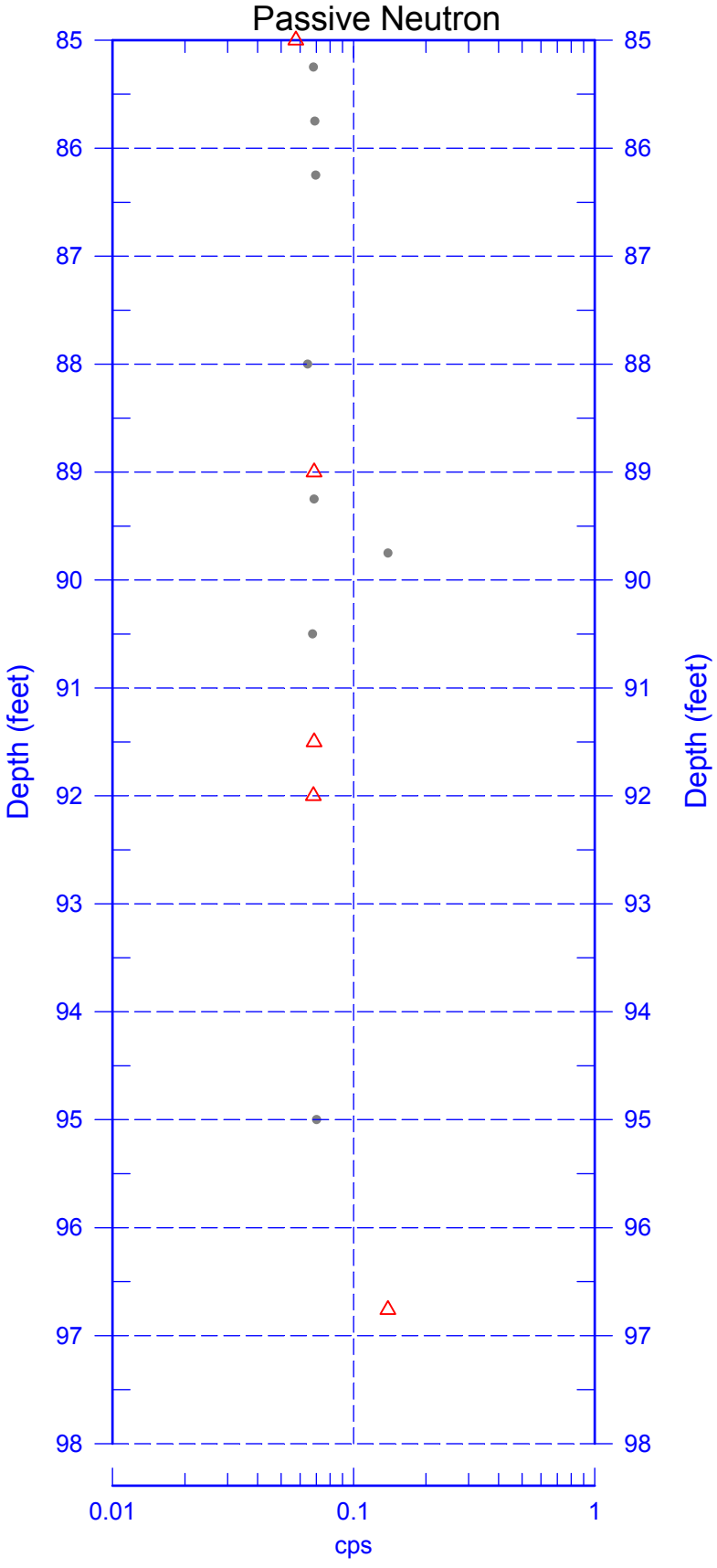
299-W15-07 (A5476)
Total Gamma & Passive Neutron



Reference - Top of Casing

Last Log Date - 04/25/05

299-W15-07 (A5476)
Passive Neutron Repeat Data



Reference - Top of Casing

Last Log Date - 04/25/05